

Research Paper

Comprehensive Analysis of Pediatric Elbow Injuries: A Cross-sectional Descriptive Study Investigating Frequency, Fracture Types, and Treatment Methods



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ABSTRACT

Background: Elbow fractures are among the most common injuries in children. While elbow fractures are rarely life-threatening, their significance lies in potential complications. Therefore, accurate and timely diagnosis and appropriate treatment are essential for elbow fractures. Identifying the frequency of pediatric visits with elbow injuries, categorized by fracture type and treatment method, is necessary for optimizing treatment planning.

Objectives: This study addresses the knowledge gap regarding pediatric elbow injuries by investigating the frequency, fracture types, and treatment methods among children seeking medical attention at Shafa Yahyaiyan Orthopedic Hospital, Tehran, Iran.

Methods: This cross-sectional, descriptive study comprised children under 18 presenting to the Emergency Department of Shafa Yahyaiyan Orthopedic Hospital due to elbow injuries from September 20, 2020, to March 20, 2021. Demographic, clinical, and radiologic variables were collected using medical records. The statistical analysis was performed using the SPSS software, version 22, with a significance level set at 0.05.

Results: A total of 507 pediatric cases with elbow injuries were analyzed, including 54% males. The average age of the cohort was 3.44±4.73 years. Pulled elbow emerged as the most common injury in 52% of cases. Among fractures, supracondylar humerus fractures had the highest prevalence. Closed reduction was the predominant intervention, followed by casting. There was no significant association between gender and injury type (P=0.211). However, a statistically significant relationship was identified between age and injury type (P=0.0001).

Conclusion: This study revealed that pulled elbow and supracondylar humerus fractures were the most common injuries, with the closed reduction being the predominant treatment method. While gender did not significantly correlate with injury type, age showed a noteworthy association, indicating an increased risk with advancing age.

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Introduction

Orthopedic injuries in children not only create psychological, social, and economic challenges for the patients and their families but can also result in long-term physical disabilities. Therefore, understanding the epidemiology of these injuries is crucial for preventing harmful incidents and ensuring suitable treatments [1, 2]. Between 42% and 64% of boys and 27% and 40% of girls are at risk of orthopedic injuries and fractures during their lifetime [3]. Almost one-third of children experience at least one fracture before the age of 17, with upper limb fractures constituting 70% of these cases [4-6].

With its complex musculoskeletal structure, the elbow joint plays a vital role as a mechanical interface in the upper limb, connecting the hand, wrist, and shoulder. Serving as the articulation point for the humerus, radius, and ulna bones, the elbow is a critical site for important ligaments, tendons, and neurovascular passages [7]. Elbow fractures are among the most common injuries in children [8]. Approximately 30% of pediatric orthopedic injuries are elbow fractures, making it the most prevalent type in India in 2015 [9]. Generally, the prevalence of elbow fractures is estimated to be around 30.8 per 10,000 children per year [10]. While elbow fractures are rarely life-threatening, their significance lies in potential complications such as neurovascular injuries, cubitus varus deformity, Volkmann's contracture, delayed healing or non-union, and ulnar nerve damage, especially in lateral condyle fractures [11]. Therefore, accurate and timely diagnosis and appropriate treatment are essential for elbow fractures, encompassing a broad spectrum from closed reduction and casting to open reduction and internal fixation [12, 13]. In addition to fractures, other injuries, such as radial head subluxation (pulled elbow), are also prevalent in children, especially those under the age of 5 [14, 15].

Identifying the frequency of pediatric visits with elbow injuries, categorized by fracture type and treatment method, is essential for optimizing treatment planning. Despite limited global studies on this topic, our search indicates a lack of relevant research in Iran. Given the differences in children's activities across various countries and potentially distinct mechanisms and locations of their injuries, this cross-sectional and descriptive study aims to analyze pediatric visits with elbow injuries, distinguishing between fracture types and treatment methods. The objective is to design educational pamphlets for families based on the obtained data, promoting the prevention of such injuries, improving the quality of children's lives, and reducing healthcare costs.

Methods

This cross-sectional, descriptive study was conducted on children under 18 presenting to the Emergency Department of *Shafa Yahyaiyan Orthopedic Hospital*, Tehran, Iran due to elbow injuries. The study was conducted from September 20, 2020, to March 20, 2021. Patient data were collected through a comprehensive review of medical records, identifying cases treated surgically and non-surgically for elbow fractures.

Demographic, clinical, and radiologic variables were collected, including age, gender, type of elbow injury (e.g. medial epicondyle dislocations and fractures, supracondylar fractures, radial head and neck fractures, Monteggia fractures, and dislocations), treatment approaches (splint, casting, closed reduction, closed reduction, and percutaneous pinning, open reduction and internal fixation, osteotomy, and titanium elastic nail), and any associated complications or comorbidities.

Confidentiality of patient identities and information was strictly maintained, and only individuals with confirmed elbow fractures and complete medical records were included in the analysis, excluding those with incomplete documentation.

Descriptive statistics were used to present the study results, including Mean±SD for quantitative variables and percentages for categorical variables. The statistical analysis was performed using the SPSS software, version 22, with a significance level set at 0.05.

Results

From September 20, 2020, to March 20, 2021, 507 children sought medical attention for elbow injuries at *Shafa Yahyaiyan Orthopedic Hospital*. Of these, 251 (54%) were males, with a mean age of 3.92±5.18 years, while the mean age for females was 2.67±4.19. The most prevalent injury observed in children was a pulled elbow, occurring in 263 individuals (52%). The distribution of elbow injuries in children is presented in [Table 1](#), indicating that epicondylar fractures had the lowest frequency, while elbow dislocation and supracondylar humerus fractures exhibited the highest prevalence. One patient was discharged with personal consent before the examination. The distribution of treatment interventions is detailed in [Table 2](#), highlighting that, in some cases, more than one therapeutic procedure was performed. Closed reduction and long arm splint (LAS) were the most commonly utilized treatments. [Table 3](#) demonstrates the frequency of injuries in females and males, respectively.

Table 1. Distribution of elbow injuries in children

Type of Elbow Injury	No. (%)
Supracondylar humerus fracture	166(32.7)
Radial head and neck fracture	7(1.4)
Monteggia fracture-dislocation	48(9.5)
Lateral condyle fracture of humerus	12(2.4)
Medial epicondyle fracture	1(0.2)
Pulled elbow	263(52)
Proximal ulna fracture (olecranon)	8(1.6)

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No significant gender-based differences were observed in the type of injuries. Chi-square analysis revealed no significant relationship between gender and the incurred injuries ($P=0.211$). Moreover, the age distribution was assessed using the k-s test, indicating non-normal age distribution ($P=0.0001$). Subsequently, the non-parametric Kruskal-Wallis test revealed a significant association between age and the incurred injuries ($P=0.0001$).

Discussion

Elbow injuries are common among children and encompass a broad spectrum of severity [16]. Accurate diagnosis of these injuries in pediatric patients can be challenging due to secondary ossification centers unique to this population [17].

Consistent with previous research, our findings underscored the prevalence of elbow injuries among children.

Although our study identified a pulled elbow as the most prevalent elbow injury among children, supracondylar fracture emerged as the predominant type of elbow fracture, similar to the previous studies. This finding was identical to the findings of prior research. Landin and colleagues (1990) conducted an epidemiological study to investigate the prevalence of elbow fractures in children. The study revealed that supracondylar and lateral condyle fractures are the most common types, predominantly occurring in boys [18]. In a 2016 study by Emery and colleagues focused on examining fractures around the elbow in children, supracondylar fractures were identified as the most common, followed by radial neck, lateral condyle, and olecranon fractures in subsequent stages [19].

In a study conducted by Andalib et al. between 2014 and 2017, supracondylar fractures were identified as the most common type of elbow fracture. The study further

Table 2. Distribution of treatment interventions

Treatment Interventions	No. (%)
Closed reduction	243(47.9)
Long arm splint	153(30.1)
Open reduction and internal fixator	31(6.1)
Closed reduction percutaneous pinning	34(6.7)
Casting	12(2.3)
Osteotomy	3(0.6)
Long arm casting	25(4.4)
Titanium elastic nail	6(1.2)

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Table 3. Frequency of injuries in girls and boys

Type of Elbow Injury	No. (%)	
	Boys	Girls
Supracondylar humerus fracture	88(32)	78(33.8)
Radial head and neck fracture	4(1.5)	3(1.3)
Monteggia fracture-dislocation	30(10.9)	18(7.8)
Lateral condyle fracture of humerus	10(3.6)	2(0.9)
Medial epicondyle fracture	1(0.4)	0(0)
Pulled elbow	136(49.5)	127(54.7)
Proximal ulna fracture (olecranon)	6(2.2)	2(0.9)

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highlighted that these fractures are more prevalent in males, particularly in the 4- to 8-year-old age group, and are more likely to occur during the spring season due to falls [8].

In addition to fractures, subluxation of the radial head, known as pulled elbow, emerged as a common occurrence in children under 5 years, as observed in Landin and Danielsson's study. Closed reduction was successful in most cases, emphasizing this intervention's efficacy [18].

In the present study, close reduction was the predominant intervention for patients with various elbow injuries, including supracondylar fractures, Monteggia fractures, lateral condyle fractures, and radial head and neck fractures. This aligns with findings from the Hill and Cooke study. Closed reduction and long-arm casts, alongside pain control, demonstrated higher frequency in both studies [13]. These findings highlight the importance of understanding injury patterns to guide clinical management effectively.

The average age of individuals in the present study was around 4 years. Additionally, a study by Andalib et al. from 2015 to 2018 revealed that supracondylar fractures were more common in children aged 4 to 8 years [8]. Generally, the risk of injuries increases with age and participation in sports activities.

In the current study, there was no significant relationship between gender and the type of injury. However, in some studies, such as Vitello et al., the pulled elbow was found to occur more frequently in girls [20], and Andalib et al. reported that supracondylar fractures were

more prevalent in males [8]. While there is limited epidemiological research on pediatric orthopedic injuries, the overall prevalence of such injuries is estimated to be around 25% among children [19, 21].

Conclusion

Our study revealed that pulled elbow and supracondylar humerus fractures were the most common injuries, with the closed reduction being the predominant treatment method. While gender did not significantly correlate with injury type, age showed a noteworthy association, indicating an increased risk with advancing age. These findings underscore the importance of tailored preventive measures and age-specific interventions for effective injury management.

While our study contributes valuable insights into pediatric elbow injuries, it is essential to acknowledge its limitations. The study's retrospective nature and reliance on medical records may have introduced selection bias and limited the scope of data available for analysis. Additionally, variations in clinical practice among physicians may have impacted the accuracy and completeness of the data.

Further research incorporating prospective data collection and larger sample sizes is warranted to validate our findings and explore additional factors influencing pediatric elbow injuries. Such studies can enhance our understanding of these injuries and inform evidence-based approaches to their diagnosis and management, ultimately improving outcomes for pediatric patients.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethical Review Board Committee of [Iran University of Medical Sciences](#).

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Authors' contributions

Conceptualization and supervision: Pouria Tabrizian and Hasan Ghandehari; Methodology: Morteza Nakhaei Amroodi and Alireza Mojani; Investigation: Mansour Karimi, Mohammadreza Bahaeddini, and Khatere Mokhtari; Data collection: Morteza Nakhaei Amroodi, Hasan Ghandehari, and Mohammadreza Bahaeddini; Data analysis: Alireza Mojani and Pouria Tabrizian; Visualization: Mansour Karimi; Writing the original draft: Khatere Mokhtari and Mansour Karimi; Review and editing: All authors.

Conflict of interest

The authors declared no conflict of interest.

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